

Assessment report No:

NIE: 52440RAN.001

Assessment report RF EXPOSURE REPORT ACCORDING TO FCC 47 CFR Part 2.1091 ISED RSS -102 Issue 5:2015

Identification of item tested.....:	Gateway
Trademark	Ericsson
Model and /or type reference	Gateway 5780
Other identification of the product	FCC ID: VV7-IOTGW5780W IC ID: 287AG-IOTGW5780W
Final HW version	R1B
Final SW version	R1A
Features	LoRaWAN Spec. 1.0.2 class A, B and C GNSS: GLONASS and GPS Tamper proof: Secure Boot by HW Secure Backhaul: IPSEC over Ethernet or 3GPP Auto recovery, Watchdog and heartbeat SNMP/MIB OSS interface Geolocation via RSSI Dynamic network tuning via band scanning
Manufacturer	ERICSSON AB Lindholmspiren, 11 41756 Göteborg, Sweden
Test method requested, standard.....:	FCC 47 CFR Part 2.1091 Radiofrequency radiation exposure evaluation: mobile devices. ISED RSS-102 Issue 5 (2015-03) – Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)
Summary	IN COMPLIANCE
Approved by (name / position & signature)	Miguel Lacave Antennas Lab Manager
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Index

Competences and guarantees.....	3
General conditions.....	3
Identification of the client	3
General description of the device under evaluation	4
Assessment summary	6
Appendix A – FCC RF Exposure	7
FCC RF Exposure evaluation for mobile devices.....	8
FCC MPE Evaluation Results.....	9
Appendix B – ISED RF Exposure.....	24
ISED RF Exposure evaluation for mobile devices	25
ISED MPE Evaluation Results	26

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Identification of the client

ERICSSON AB
Lindholmspiren, 11
41756 Göteborg, Sweden

General description of the device under evaluation

The device under evaluation consists of an outdoor gateway unit for several WWAN technologies and for Low Power LoRaWAN™ networks, which works into the 902-928MHz ISM frequency band.

The device will be installed at height following the instructions for wall mount or pole mount installations of the device's manual, using one of the antenna alternatives for the final installation. The minimum separation distance once installed between the gateway and nearby persons will be more than 50 cm.

The equipment specifications declared by the manufacturer for cellular supported features are:

Band (MHz)	Technology	Band	Maximum RF output power (dBm)	MaximumAverage RF output power (dBm)	Tune-up tolerance (dBm)
850	GSM/GPRS	850	32.50*	29.49	+1/-1
1900	GSM/GPRS	1900	29.50*	26.49	+1/-1
1900	WCDMA/HSPA	II	23.00	23.00	+1/-1
1700	WCDMA/HSPA	IV	23.00	23.00	+1/-1
850	WCDMA/HSPA	V	23.00	23.00	+1/-1
1900	LTE	2	23.00	23.00	+1/-1
1700	LTE	4	23.00	23.00	+1/-1
850	LTE	5	23.00	23.00	+1/-1
750	LTE	13	23.00	23.00	+1/-1
700	LTE	17	23.00	23.00	+1/-1
1900	LTE	25	23.00	23.00	+1/-1

Table 1: WWAN specifications

*Note: For the GSM/GPRS modes, the maximum average RF output power has been calculated according to the supported GPRS slots configuration. According to the device multiclass slot for GPRS technology, there will be up to 4 uplink time slots available for transmission, with its respective duty cycle and its average output power for each configuration.

1 Slot uplink: Duty cycle =1/8 → 12.5%

2 Slots uplink: Duty cycle =2/8 → 25.0%

3 Slots uplink: Duty cycle =3/8 → 37.5%

4 Slots uplink: Duty cycle =4/8 → 50.0%

GSM 900							
Maximum RF Output Power (dBm)				Average Output Power (dBm)			
32.5				23.47			
GPRS 900							
Maximum RF Output Power (dBm)				Average Output Power (dBm)			
1 Slot	2 Slots	3 Slots	4 Slots	1 Slot	2 Slots	3 Slots	4 Slots
32.50	32.50	32.50	32.50	23.47	26.48	28.24	29.49
GSM 1800							
Maximum RF Output Power (dBm)				Average Output Power (dBm)			
29.5				20.47			
GPRS 1800							
Maximum RF Output Power (dBm)				Average Output Power (dBm)			
1 Slot	2 Slots	3 Slots	4 Slots	1 Slot	2 Slots	3 Slots	4 Slots
29.50	29.50	29.50	29.50	20.47	23.48	25.24	26.49

Table 2: GSM average output power values

For LoRa technology there will be two different output power configurations:

Frequency Band (MHz)	Technology	Band	Maximum RF output power (dBm)
902-928	LoRa Config 1	ISM	27.34
902-928	LoRa Config 2	ISM	24.47

Table 3: LoRa specifications

The maximum average radiated output power according to the maximum antenna gains declared by the manufacturer for each transmitting configuration will be:

Assessment	Band (MHz)	Technology	Band	MaximumAverage RF output power (dBm)	Antenna	Max. antenna gain (dBi)	Average radiated power (E.I.R.P.) (dBm)
1	850	GSM/GPRS	850	30.49	Cellular	+2.0	32.49
2	1900	GSM/GPRS	1900	27.49		+2.0	29.49
3	1900	WCDMA/HSPA	II	24.00		+2.0	26.00
4	1700	WCDMA/HSPA	IV	24.00		+2.0	26.00
5	850	WCDMA/HSPA	V	24.00		+2.0	26.00
6	1900	LTE	2	24.00		+2.0	26.00
7	1700	LTE	4	24.00		+2.0	26.00
8	850	LTE	5	24.00		+2.0	26.00
9	750	LTE	13	24.00		+2.0	26.00
10	700	LTE	17	24.00		+2.0	26.00
11	1900	LTE	25	24.00		+2.0	26.00
12	902-928	LoRa Config 1	ISM	27.34	LoRa 1	+2.0	29.34
13	902-928	LoRa Config 2	ISM	24.47	LoRa 2	+11.0	35.47

Table 4: Antenna gains and maximum E.I.R.P.

Assessment summary

Radiofrequency radiation exposure limits				
FCC 47 CFR § 2.1091 & ISED RSS-102 Issue 5 (2015-03)				
Assessment	Antenna	Band	Technology	VERDICT (Pass/Fail)
1	Cellular	850	GSM/GPRS	Pass
2		1900	GSM/GPRS	Pass
3		II	WCDMA/HSPA	Pass
4		IV	WCDMA/HSPA	Pass
5		V	WCDMA/HSPA	Pass
6		2	LTE	Pass
7		4	LTE	Pass
8		5	LTE	Pass
9		13	LTE	Pass
10		17	LTE	Pass
11		25	LTE	Pass
12	LoRa Antenna 1	ISM 902-928	LoRa Config 1	Pass
13	LoRa Antenna 2	ISM 902-928	LoRa Config 2	Pass

Table 5: Assessment summary.

Appendix A – FCC RF Exposure

FCC RF Exposure evaluation for mobile devices

Devices operating in standalone mobile device exposure conditions may contain a single transmitter or multiple transmitters that do not transmit simultaneously. A minimum test separation distance ≥ 20 cm is required between the antenna and radiating structures of the device and nearby persons to apply mobile device exposure limits. The distance must be at least 20 cm and fully supported by the operating and installation configurations of the transmitter and its antenna(s), according to the source-based time-averaged maximum power requirements of § 2.1091(d)(2). In cases where cable losses or other attenuations are applied to determine compliance, the most conservative operating configurations and exposure conditions must be evaluated. The minimum test separation distance required for a device to comply with mobile device exposure conditions must be clearly identified in the installation and operating instructions, for all installation and exposure conditions, to enable users and installers to comply with RF exposure requirements. For mobile devices that have the potential to operate in portable device exposure conditions, similar to the configurations described in § 2.1091(d)(4), a KDB inquiry is required to determine the SAR test requirements for demonstrating compliance.

When a device qualifies for the categorical exclusion provision of § 2.1091(c), the minimum test separation distance may be estimated, when applicable, by simple calculations according to plane-wave equivalent conditions, to ensure the transmitter and its antenna(s) can operate in manners that meet or exceed the estimated distance. The source-based time-averaged maximum radiated power, according to the maximum antenna gain, must be applied to calculate the field strength and power density required to establish the minimum test separation distance. When the estimated test separation distance becomes overly conservative and does not support compliance, MPE measurement or computational modeling may be used to determine the required minimum separation distance.

According to §1.1310 Radiofrequency radiation exposure limits, paragraph (e), the limits for Maximum Permissible Exposure (MPE) to radiofrequency electromagnetic fields are:

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposure				
0.3–3.0	614	1.63	* 100	6
3.0–30	1842/f	4.89/f	* 900/f ²	6
30–300	61.4	0.163	1.0	6
300–1,500			f/300	6
1,500–100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	* 100	30
1.34–30	824/f	2.19/f	* 180/f ²	30
30–300	27.5	0.073	0.2	30
300–1,500			f/1500	30
1,500–100,000			1.0	30

f = frequency in MHz * = Plane-wave equivalent power density

FCC MPE Evaluation Results

In order to perform the assessment, the following equations have been used for the calculations:

$$\text{Power density: } S[mW/cm^2] = \frac{P_{E.I.R.P.}[mW]}{4\pi R[cm]^2}$$

$$\text{Minimum compliance distance: } R_{\min}[m] = \sqrt{\frac{P_{E.I.R.P.}[mW]}{4\pi S[mW/cm^2]}}$$

Where:

S = power density

$P_{E.I.R.P.}$ = Equivalent isotropically radiated power

R = distance to the center of radiation of the antenna (evaluation distance)

R_{\min} = distance to the center of radiation of the antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

P_{\max} = power input to the antenna

Assessment 1 – GSM 850

Maximum output power (dBm):	30.49
Antenna Gain (dBi):	2.0
Minimum use distance (cm):	50.0
Worst Case Frequency (MHz):	824.0
Maximum EIRP (dBm):	32.49
Maximum EIRP (mW):	1774.19
General public - Power density limit (mW/cm2):	0.549

Power density at minimum use distance:

Power density (mW/cm2):	0.06
Verdict for general public:	PASS

The power density level for this transmission mode is below general public and controlled exposure power density limits.

Minimum compliance distance for this technology:

Minimum distance for general public (cm):	16.03
Verdict for general public:	PASS

The minimum use distance is larger than general public and controlled exposure minimum compliance distances.

Assessment 2 – GSM 1900

Maximum output power (dBm):	27.49
Antenna Gain (dBi):	2.0
Minimum use distance (cm):	50.0
Worst Case Frequency (MHz):	1850.0
Maximum EIRP (dBm):	29.49
Maximum EIRP (mW):	889.20
General public - Power density limit (mW/cm2):	1.0

Power density at minimum use distance:

Power density (mW/cm2):	0.03
Verdict for general public:	PASS

The power density level for this transmission mode is below general public and controlled exposure power density limits.

Minimum compliance distance for this technology:

Minimum distance for general public (cm):	8.41
Verdict for general public:	PASS

The minimum use distance is larger than general public and controlled exposure minimum compliance distances.

Assessment 3 – WCDMA Band II

Maximum output power (dBm):	24.0
Antenna Gain (dBi):	2.0
Minimum use distance (cm):	50.0
Worst Case Frequency (MHz):	1850.0
Maximum EIRP (dBm):	26.0
Maximum EIRP (mW):	398.11
General public - Power density limit (mW/cm2):	1.0

Power density at minimum use distance:

Power density (mW/cm2):	0.01
Verdict for general public:	PASS

The power density level for this transmission mode is below general public and controlled exposure power density limits.

Minimum compliance distance for this technology:

Minimum distance for general public (cm):	5.63
Verdict for general public:	PASS

The minimum use distance is larger than general public and controlled exposure minimum compliance distances.

Assessment 4 – WCDMA Band IV

Maximum output power (dBm):	24.0
Antenna Gain (dBi):	2.0
Minimum use distance (cm):	50.0
Worst Case Frequency (MHz):	1710.0
Maximum EIRP (dBm):	26.0
Maximum EIRP (mW):	398.11
General public - Power density limit (mW/cm2):	1.0

Power density at minimum use distance:

Power density (mW/cm2):	0.01
Verdict for general public:	PASS

The power density level for this transmission mode is below general public and controlled exposure power density limits.

Minimum compliance distance for this technology:

Minimum distance for general public (cm):	5.63
Verdict for general public:	PASS

The minimum use distance is larger than general public and controlled exposure minimum compliance distances.

Assessment 5 – WCDMA Band V

Maximum output power (dBm):	24.0
Antenna Gain (dBi):	2.0
Minimum use distance (cm):	50.0
Worst Case Frequency (MHz):	824.0
Maximum EIRP (dBm):	26.0
Maximum EIRP (mW):	398.11
General public - Power density limit (mW/cm2):	0.549

Power density at minimum use distance:

Power density (mW/cm2):	0.01
Verdict for general public:	PASS

The power density level for this transmission mode is below general public and controlled exposure power density limits.

Minimum compliance distance for this technology:

Minimum distance for general public (cm):	7.59
Verdict for general public:	PASS

The minimum use distance is larger than general public and controlled exposure minimum compliance distances.

Assessment 6 – LTE Band 2

Maximum output power (dBm):	24.0
Antenna Gain (dBi):	2.0
Minimum use distance (cm):	50.0
Worst Case Frequency (MHz):	1850.0
Maximum EIRP (dBm):	26.0
Maximum EIRP (mW):	398.11
General public - Power density limit (mW/cm2):	1.0

Power density at minimum use distance:

Power density (mW/cm2):	0.01
Verdict for general public:	PASS

The power density level for this transmission mode is below general public and controlled exposure power density limits.

Minimum compliance distance for this technology:

Minimum distance for general public (cm):	5.63
Verdict for general public:	PASS

The minimum use distance is larger than general public and controlled exposure minimum compliance distances.

Assessment 7 – LTE Band 4

Maximum output power (dBm):	24.0
Antenna Gain (dBi):	2.0
Minimum use distance (cm):	50.0
Worst Case Frequency (MHz):	1710.0
Maximum EIRP (dBm):	26.0
Maximum EIRP (mW):	398.11
General public - Power density limit (mW/cm2):	1.0

Power density at minimum use distance:

Power density (mW/cm2):	0.01
Verdict for general public:	PASS

The power density level for this transmission mode is below general public and controlled exposure power density limits.

Minimum compliance distance for this technology:

Minimum distance for general public (cm):	5.63
Verdict for general public:	PASS

The minimum use distance is larger than general public and controlled exposure minimum compliance distances.

Assessment 8 – LTE Band 5

Maximum output power (dBm):	24.0
Antenna Gain (dBi):	2.0
Minimum use distance (cm):	50.0
Worst Case Frequency (MHz):	824.0
Maximum EIRP (dBm):	26.0
Maximum EIRP (mW):	398.11
General public - Power density limit (mW/cm2):	0.549

Power density at minimum use distance:

Power density (mW/cm2):	0.01
Verdict for general public:	PASS

The power density level for this transmission mode is below general public and controlled exposure power density limits.

Minimum compliance distance for this technology:

Minimum distance for general public (cm):	7.59
Verdict for general public:	PASS

The minimum use distance is larger than general public and controlled exposure minimum compliance distances.

Assessment 9 – LTE Band 13

Maximum output power (dBm):	24.0
Antenna Gain (dBi):	2.0
Minimum use distance (cm):	50.0
Worst Case Frequency (MHz):	777.0
Maximum EIRP (dBm):	26.0
Maximum EIRP (mW):	398.11
General public - Power density limit (mW/cm2):	0.518

Power density at minimum use distance:

Power density (mW/cm2):	0.01
Verdict for general public:	PASS

The power density level for this transmission mode is below general public and controlled exposure power density limits.

Minimum compliance distance for this technology:

Minimum distance for general public (cm):	7.82
Verdict for general public:	PASS

The minimum use distance is larger than general public and controlled exposure minimum compliance distances.

Assessment 10 – LTE Band 17

Maximum output power (dBm):	24.0
Antenna Gain (dBi):	2.0
Minimum use distance (cm):	50.0
Worst Case Frequency (MHz):	704.0
Maximum EIRP (dBm):	26.0
Maximum EIRP (mW):	398.11
General public - Power density limit (mW/cm2):	0.469

Power density at minimum use distance:

Power density (mW/cm2):	0.01
Verdict for general public:	PASS

The power density level for this transmission mode is below general public and controlled exposure power density limits.

Minimum compliance distance for this technology:

Minimum distance for general public (cm):	8.22
Verdict for general public:	PASS

The minimum use distance is larger than general public and controlled exposure minimum compliance distances.

Assessment 11 – LTE Band 25

Maximum output power (dBm):	24.0
Antenna Gain (dBi):	2.0
Minimum use distance (cm):	50.0
Worst Case Frequency (MHz):	1850.0
Maximum EIRP (dBm):	26.0
Maximum EIRP (mW):	398.11
General public - Power density limit (mW/cm2):	1.0

Power density at minimum use distance:

Power density (mW/cm2):	0.01
Verdict for general public:	PASS

The power density level for this transmission mode is below general public and controlled exposure power density limits.

Minimum compliance distance for this technology:

Minimum distance for general public (cm):	5.63
Verdict for general public:	PASS

The minimum use distance is larger than general public and controlled exposure minimum compliance distances.

Assessment 12 – LoRa – Antenna 1

Maximum output power (dBm):	27.34
Antenna Gain (dBi):	2.0
Minimum use distance (cm):	50.0
Worst Case Frequency (MHz):	927.5
Maximum EIRP (dBm):	29.34
Maximum EIRP (mW):	859.01
General public - Power density limit (mW/cm2):	0.618

Power density at minimum use distance:

Power density (mW/cm2):	0.03
Verdict for general public:	PASS

The power density level for this transmission mode is below general public and controlled exposure power density limits.

Minimum compliance distance for this technology:

Minimum distance for general public (cm):	10.51
Verdict for general public:	PASS

The minimum use distance is larger than general public and controlled exposure minimum compliance distances.

Assessment 13 – LoRa – Antenna 2

Maximum output power (dBm):	24.47
Antenna Gain (dBi):	11.0
Minimum use distance (cm):	50.0
Worst Case Frequency (MHz):	927.5
Maximum EIRP (dBm):	35.47
Maximum EIRP (mW):	3523.71
General public - Power density limit (mW/cm2):	0.618

Power density at minimum use distance:

Power density (mW/cm2):	0.11
Verdict for general public:	PASS

The power density level for this transmission mode is below general public and controlled exposure power density limits.

Minimum compliance distance for this technology:

Minimum distance for general public (cm):	21.30
Verdict for general public:	PASS

The minimum use distance is larger than general public and controlled exposure minimum compliance distances.

Multiple frequencies assessment

When multiple sources are introduced into an environment, it becomes necessary to address the sources interdependently, since each source will contribute some percentage of the maximum exposure toward the total exposure at a fixed location. The sum of the ratios of the exposure from each source to the corresponding maximum exposure for the frequency of each source must be evaluated.

The exposure complies with the maximum permissible exposure if the sum of the ratios is less than unity:

$$\sum_{i=1}^n \frac{S_i}{MPE_i} < 1$$

Where

S_i is the power density of each source;

MPE_i is the power density basic restriction of each source.

The device can transmit simultaneously using the cellular antenna and one of the LoRA configurations. The worst case combination will be simultaneous transmission using GSM 850 and LoRA configuration 2 at the same time:

$$\frac{0.06}{0.549} + \frac{0.11}{0.618} = 0.11 + 0.18 = 0.29 < 1 \text{ Limit}$$

Appendix B – ISED RF Exposure

ISED RF Exposure evaluation for mobile devices

According to RSS-102 Issue 5, Paragraph “4. Exposure Limits”, Industry of Canada has adopted the RF field strength limits established in Health Canada’s RF exposure guideline, Safety code 6:

**Table 4: RF Field Strength Limits for Devices Used by the General Public
(Uncontrolled Environment)**

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Reference Period (minutes)
0.003-10 ²¹	83	90	-	Instantaneous*
0.1-10	-	0.73/ f	-	6**
1.1-10	87/ $f^{0.5}$	-	-	6**
10-20	27.46	0.0728	2	6
20-48	58.07/ $f^{0.25}$	0.1540/ $f^{0.25}$	8.944/ $f^{0.5}$	6
48-300	22.06	0.05852	1.291	6
300-6000	3.142 $f^{0.3417}$	0.008335 $f^{0.3417}$	0.02619 $f^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/ $f^{1.2}$
150000-300000	0.158 $f^{0.5}$	4.21 x 10 ⁻⁴ $f^{0.5}$	6.67 x 10 ⁻⁵ f	616000/ $f^{1.2}$
<p>Note: f is frequency in MHz. *Based on nerve stimulation (NS). ** Based on specific absorption rate (SAR).</p>				

ISED MPE Evaluation Results

In order to perform the assessment, the following equations have been used for the calculations:

$$\text{Power density: } S[W/m^2] = \frac{P_{E.I.R.P.}[W]}{4\pi R[m]^2}$$

$$\text{Minimum compliance distance: } R_{\min}[m] = \sqrt{\frac{P_{E.I.R.P.}[W]}{4\pi S[W/m^2]}}$$

Where:

S = power density

$P_{E.I.R.P.}$ = Equivalent isotropically radiated power

R = distance to the center of radiation of the antenna (evaluation distance)

R_{\min} = distance to the center of radiation of the antenna

Assessment 1 – GSM 850

Maximum output power (dBm):	30.49
Antenna Gain (dBi):	2.0
Minimum use distance (cm):	50.0
Worst Case Frequency (MHz):	824.0
Maximum EIRP (dBm):	32.49
Maximum EIRP (mW):	1774.19
General public - Power density limit (W/m2):	2.575

Power density at minimum use distance:

Power density (W/m2):	0.56
Verdict for general public:	PASS

The power density level for this transmission mode is below general public and controlled exposure power density limits.

Minimum compliance distance for this technology:

Minimum distance for general public (cm):	23.41
Verdict for general public:	PASS

The minimum use distance is larger than general public and controlled exposure minimum compliance distances.

Assessment 2 – GSM 1900

Maximum output power (dBm):	27.49
Antenna Gain (dBi):	2.0
Minimum use distance (cm):	50.0
Worst Case Frequency (MHz):	1850.0
Maximum EIRP (dBm):	29.49
Maximum EIRP (mW):	889.20
General public - Power density limit (mW/cm2):	4.476

Power density at minimum use distance:

Power density (mW/cm2):	0.28
Verdict for general public:	PASS

The power density level for this transmission mode is below general public and controlled exposure power density limits.

Minimum compliance distance for this technology:

Minimum distance for general public (cm):	12.57
Verdict for general public:	PASS

The minimum use distance is larger than general public and controlled exposure minimum compliance distances.

Assessment 3 – WCDMA Band II

Maximum output power (dBm):	24.0
Antenna Gain (dBi):	2.0
Minimum use distance (cm):	50.0
Worst Case Frequency (MHz):	1850.0
Maximum EIRP (dBm):	26.0
Maximum EIRP (mW):	398.11
General public - Power density limit (W/m2):	4.476

Power density at minimum use distance:

Power density (W/m2):	0.13
Verdict for general public:	PASS

The power density level for this transmission mode is below general public and controlled exposure power density limits.

Minimum compliance distance for this technology:

Minimum distance for general public (cm):	8.41
Verdict for general public:	PASS

The minimum use distance is larger than general public and controlled exposure minimum compliance distances.

Assessment 4 – WCDMA Band IV

Maximum output power (dBm):	24.0
Antenna Gain (dBi):	2.0
Minimum use distance (cm):	50.0
Worst Case Frequency (MHz):	1710.0
Maximum EIRP (dBm):	26.0
Maximum EIRP (mW):	398.11
General public - Power density limit (mW/cm2):	4.241

Power density at minimum use distance:

Power density (mW/cm2):	0.13
Verdict for general public:	PASS

The power density level for this transmission mode is below general public and controlled exposure power density limits.

Minimum compliance distance for this technology:

Minimum distance for general public (cm):	8.64
Verdict for general public:	PASS

The minimum use distance is larger than general public and controlled exposure minimum compliance distances.

Assessment 5 – WCDMA Band V

Maximum output power (dBm):	24.0
Antenna Gain (dBi):	2.0
Minimum use distance (cm):	50.0
Worst Case Frequency (MHz):	824.0
Maximum EIRP (dBm):	26.0
Maximum EIRP (mW):	398.11
General public - Power density limit (W/m2):	2.575

Power density at minimum use distance:

Power density (W/m2):	0.13
Verdict for general public:	PASS

The power density level for this transmission mode is below general public and controlled exposure power density limits.

Minimum compliance distance for this technology:

Minimum distance for general public (cm):	11.09
Verdict for general public:	PASS

The minimum use distance is larger than general public and controlled exposure minimum compliance distances.

Assessment 6 – LTE Band 2

Maximum output power (dBm):	24.0
Antenna Gain (dBi):	2.0
Minimum use distance (cm):	50.0
Worst Case Frequency (MHz):	1850.0
Maximum EIRP (dBm):	26.0
Maximum EIRP (mW):	398.11
General public - Power density limit (mW/cm2):	4.476

Power density at minimum use distance:

Power density (mW/cm2):	0.13
Verdict for general public:	PASS

The power density level for this transmission mode is below general public and controlled exposure power density limits.

Minimum compliance distance for this technology:

Minimum distance for general public (cm):	8.41
Verdict for general public:	PASS

The minimum use distance is larger than general public and controlled exposure minimum compliance distances.

Assessment 7 – LTE Band 4

Maximum output power (dBm):	24.0
Antenna Gain (dBi):	2.0
Minimum use distance (cm):	50.0
Worst Case Frequency (MHz):	1710.0
Maximum EIRP (dBm):	26.0
Maximum EIRP (mW):	398.11
General public - Power density limit (W/m ²):	4.241

Power density at minimum use distance:

Power density (W/m ²):	0.13
Verdict for general public:	PASS

The power density level for this transmission mode is below general public and controlled exposure power density limits.

Minimum compliance distance for this technology:

Minimum distance for general public (cm):	8.64
Verdict for general public:	PASS

The minimum use distance is larger than general public and controlled exposure minimum compliance distances.

Assessment 8 – LTE Band 5

Maximum output power (dBm):	24.0
Antenna Gain (dBi):	2.0
Minimum use distance (cm):	50.0
Worst Case Frequency (MHz):	824.0
Maximum EIRP (dBm):	26.0
Maximum EIRP (mW):	398.11
General public - Power density limit (mW/cm2):	2.575

Power density at minimum use distance:

Power density (mW/cm2):	0.13
Verdict for general public:	PASS

The power density level for this transmission mode is below general public and controlled exposure power density limits.

Minimum compliance distance for this technology:

Minimum distance for general public (cm):	11.09
Verdict for general public:	PASS

The minimum use distance is larger than general public and controlled exposure minimum compliance distances.

Assessment 9 – LTE Band 13

Maximum output power (dBm):	24.0
Antenna Gain (dBi):	2.0
Minimum use distance (cm):	50.0
Worst Case Frequency (MHz):	777.0
Maximum EIRP (dBm):	26.0
Maximum EIRP (mW):	398.11
General public - Power density limit (W/m2):	2.474

Power density at minimum use distance:

Power density (W/m2):	0.13
Verdict for general public:	PASS

The power density level for this transmission mode is below general public and controlled exposure power density limits.

Minimum compliance distance for this technology:

Minimum distance for general public (cm):	11.32
Verdict for general public:	PASS

The minimum use distance is larger than general public and controlled exposure minimum compliance distances.

Assessment 10 – LTE Band 17

Maximum output power (dBm):	24.0
Antenna Gain (dBi):	2.0
Minimum use distance (cm):	50.0
Worst Case Frequency (MHz):	704.0
Maximum EIRP (dBm):	26.0
Maximum EIRP (mW):	398.11
General public - Power density limit (W/m2):	2.312

Power density at minimum use distance:

Power density (W/m2):	0.13
Verdict for general public:	PASS

The power density level for this transmission mode is below general public and controlled exposure power density limits.

Minimum compliance distance for this technology:

Minimum distance for general public (cm):	11.70
Verdict for general public:	PASS

The minimum use distance is larger than general public and controlled exposure minimum compliance distances.

Assessment 11 – LTE Band 25

Maximum output power (dBm):	24.0
Antenna Gain (dBi):	2.0
Minimum use distance (cm):	50.0
Worst Case Frequency (MHz):	1850.0
Maximum EIRP (dBm):	26.0
Maximum EIRP (mW):	398.11
General public - Power density limit (mW/cm2):	4.476

Power density at minimum use distance:

Power density (mW/cm2):	0.13
Verdict for general public:	PASS

The power density level for this transmission mode is below general public and controlled exposure power density limits.

Minimum compliance distance for this technology:

Minimum distance for general public (cm):	8.41
Verdict for general public:	PASS

The minimum use distance is larger than general public and controlled exposure minimum compliance distances.

Assessment 12 – LoRa – Antenna 1

Maximum output power (dBm):	27.34
Antenna Gain (dBi):	2.0
Minimum use distance (cm):	50.0
Worst Case Frequency (MHz):	927.5
Maximum EIRP (dBm):	29.34
Maximum EIRP (mW):	859.01
General public - Power density limit (mW/cm2):	2.792

Power density at minimum use distance:

Power density (mW/cm2):	0.27
Verdict for general public:	PASS

The power density level for this transmission mode is below general public and controlled exposure power density limits.

Minimum compliance distance for this technology:

Minimum distance for general public (cm):	15.65
Verdict for general public:	PASS

The minimum use distance is larger than general public and controlled exposure minimum compliance distances.

Assessment 13 – LoRa – Antenna 2

Maximum output power (dBm):	24.47
Antenna Gain (dBi):	11.0
Minimum use distance (cm):	50.0
Worst Case Frequency (MHz):	927.5
Maximum EIRP (dBm):	35.47
Maximum EIRP (mW):	3523.71
General public - Power density limit (W/m2):	2.792

Power density at minimum use distance:

Power density (W/m2):	1.12
Verdict for general public:	PASS

The power density level for this transmission mode is below general public and controlled exposure power density limits.

Minimum compliance distance for this technology:

Minimum distance for general public (cm):	31.69
Verdict for general public:	PASS

The minimum use distance is larger than general public and controlled exposure minimum compliance distances.

Multiple frequencies assessment

When multiple sources are introduced into an environment, it becomes necessary to address the sources interdependently, since each source will contribute some percentage of the maximum exposure toward the total exposure at a fixed location. The sum of the ratios of the exposure from each source to the corresponding maximum exposure for the frequency of each source must be evaluated.

The exposure complies with the maximum permissible exposure if the sum of the ratios is less than unity:

$$\sum_{i=1}^n \frac{S_i}{MPE_i} < 1$$

Where

S_i is the power density of each source;

MPE_i is the power density basic restriction of each source.

The device can transmit simultaneously using the cellular antenna and one of the LoRA configurations. The worst case combination will be simultaneous transmission using GSM 850 and LoRA configuration 2 at the same time:

$$\frac{0.56}{2.575} + \frac{1.12}{2.792} = 0.22 + 0.401 = 0.621 < 1 \text{ Limit}$$